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CONSTITUENT PRINCIPLE OF HEALTHY
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LETTER ADDRESSED TO THE SECRETARY OF
THE MEDICO-CHIRURGICAL SOCIETY.

By BENJAMIN G. BABINGTON, M.D. F.R.S.

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Read Feb. 23, 1830.

TO THE SECRETARY TO THE MEDICO-CHIRURGICAL
SOCIETY.

48, Finsbury Square, Feb. 12, 1830.

SIR,

I REQUEST you will do me the honour to lay before the Medico-Chirurgical Society, the following remarks on a concrete oil, which I have lately found to exist as a constituent in Blood, and a specimen of which I send for the inspection of the Society.

This oil is obtained from the serum of healthy Blood, whether that serum be milky, opalescent,

or clear, and appears to be the chief, if not the only cause, of the colour of healthy serum.

It is of a deep yellow hue, is semisolid, and melts at a temperature of 90° Fahrenheit. It is lighter than water, its specific gravity being $\cdot 918$. From its solution in æther, it crystallizes by very slow evaporation, at a low temperature, in radiated tufts. It burns with a brilliant light, has a faint and peculiar odour, resembling that of a wet bladder, forms soaps with the alkalis, and in its general characters resembles other animal oils. It is uniform in colour, in general appearance, and in all its properties, from whatever kind of serum it be obtained.

The only method by which I have succeeded in separating it from clear healthy serum, is by agitation with æther, though from milky serum, in which it abounds, it may be obtained by means of alcohol, or by simple evaporation.

About one-third part of æther should be added to the serum, in a well-corked phial, which should then be reversed a few times, without violent agitation. This movement should be repeated twice or thrice, at intervals of a day or two, when after a final rest of some hours, the æther will be found to have risen to the top of the liquid, and to have acquired by impregnation with oil, a yellow colour of more or less depth, according to the pro-

portion of oil which the serum may have contained. By means of a glass syringe, the æthereal solution may be collected from the surface of the serum, and on evaporation, will yield the material in question, together with a small quantity of albumen, which the æther had taken up, and which may be easily separated by a heat sufficient to coagulate it. By a more violent agitation of the æther and the serum, an imperfect coagulation of the latter generally takes place, which in that state entangles the æther so as to prevent its separation. This effect more especially occurs, if the æther be charged with certain impurities.

Hewson, in speaking of what he calls *white serum*, says, “that although the serum of blood be naturally transparent, and a little yellowish, yet it is frequently found to have the appearance of whey, and sometimes to have white streaks swimming on its surface, like a cream, and now and then to be as white as milk, while the coagulum is as red as usual.” In all these cases he states, that he has examined it microscopically, and found it to contain very small globules.

He then describes these, and after citing several cases from authors, and from the practice of his friends, of the occurrence of milky serum, he states his reason for thinking this appearance not to be owing to the patient’s having been bled after a meal, or to the introduction of unconverted

chyle into the blood, but to a vast number of small globules like those of milk. "These latter being known to be oily, I conclude," says he, "that these in the human serum when white were oily likewise; and recollecting to have read somewhere of an experiment by which butter had been got from such human serum, I tried, by agitating some of it a little diluted, to separate its oil, or to churn it, but without success. I then inspissated some of it to dryness, and compared it with the natural serum of human blood, prepared in the same way, and found it less tenacious, and much more inflammable, and when this was dried, its oil oozed out so much as to make the paper in which it was kept greasy." p. 148.

This quotation I have given at large, in order that we may judge how far there was reason for doubting Mr. Hewson's conclusions, and what degree of originality we should attribute to the experiments of subsequent investigators.

John Hunter, in speaking of milky or wheyish serum, says, that "there have been many opinions formed about the nature and cause of this appearance. It has been supposed to be occasioned by chyle not yet assimilated, but it does not occur frequently enough to be attributed to this fluid. Mr. Hewson supposed it to be absorbed fat or oil, which certainly is not the case, for it is not the same in all cases."

Mr. Hunter's high authority, and positive denial of the truth of Mr. Hewson's supposition, I might almost say demonstration, that the whiteness in question was owing to oil or fat, probably prevented the institution of more decisive experiments, to set the matter beyond a doubt.

His reason for denying, that it is occasioned by chyle, as well as that which he gives for deciding that it is not absorbed fat or oil, falls to the ground; for though milkiness does not occur frequently, oil is always present; and so far from its not being the same in all cases, it is, as I have said, remarkably uniform, from whatever kind of serum procured.

In the *Edinburgh Medical and Surgical Journal* for April 1821, there is a paper by Dr. Traill, of Liverpool, headed, "Oil detected in the Serum of Blood, drawn from a person labouring under internal inflammation." The case is then stated; the serum, with its milky characters described minutely, and the following proofs adduced of its oily nature. 1st, That when dried, it stained paper with greasy marks, which were permanent. 2dly, That its dried fragments had a greasy appearance, and left an oily film of consolidated greasy matter in the capsules which had been used, which film was readily melted by a gentle increase of temperature. Lastly, That this minute portion of oily matter was absorbed by

means of amianthus, and produced a flame on the application of an ignited body.

In the number for October of the same year, the same author states, that he had examined another portion of similar serum, and had obtained by evaporation and the application of bibulous paper, a further portion of this oil, the quantity of which he estimated at 2.44 per cent.

In April 1823, Dr. Traill again examined the milky serum of another person, and by the same means as before, namely, evaporation and the use of bibulous paper, obtained again a result differing only as respected the proportion of oil, which in this case amounted to 4.5 per cent.

This investigator's claim to having advanced our knowledge on this subject, rests on his having rendered, more evident than Hewson had done, the existence of oil in the cases in question, by the use of amianthus, and on his having, by means of bibulous paper, inferred in two instances its proportions.

But although he separated it so completely as to demonstrate its existence beyond all doubt, yet he did not collect it in sufficient quantity to determine its specific gravity, or its melting point. His account of the oil was, that it was transparent, of a yellowish colour, and perfectly fluid

when hot, but solid, opaque, and greyish white, at the usual temperature of the air. He considered the presence of oil as connected with inflammatory disease, and suspected its presence only in milky serum.

Finally, in the number for October last, of the Journal already quoted, Dr. Christison writes as follows:—"A very common appearance of the serum of the blood in this disease, (dropsy from diseased kidney,) is a slight milkiness amounting to opalescence. This state I conceive to depend on the presence of a little oil in the blood. I have several times detected oil in opaline serum, by agitating it in a tube with æther, allowing the mixture to remain at rest for a few seconds, and withdrawing and evaporating the ætherial fluid, which rises to the top."

Dr. Christison thus, in common with Dr. Traill and Mr. Hewson, conceives the presence of oil to be necessarily connected with the opalescent appearance of serum, and I conclude, also, with a state of disease.

This gentleman's improvement consists in his employing æther as a solvent of the oil in question; but as he thus contented himself with obtaining mere evidence of the existence of unctuous matter, without collecting it in any quantity, he did not derive the advantage from this

method which it is capable of furnishing, nor add to the facts already known on the subject. Let me not, however, be understood by this remark, to impute it as a fault to the intelligent author of the paper on Dropsy from Diseased Kidney, that he did not go further. He was engaged in another highly important investigation, and his notice of oil in opalescent serum, is quite subordinate to his main subject, and occupies only a single paragraph.

I cannot lay claim to having preceded him in the employment of æther as a solvent, but when I first used it in the separation of the oil from milky serum, I was not aware of his experiments, having only within the last ten days been made acquainted with them.

This method I first had recourse to on the 26th of October last, and was pleased to find how completely it succeeded. The blood from which I procured the specimen on which I operated, was that of a diabetic patient of middle age. The serum was as white and opaque as milk, had a specific gravity of 1024, and contained exactly 3 per cent. of oil. I procured upwards of a drachm on this occasion. I next examined in succession the serum of twelve different individuals labouring under various forms of disease, and in every case I found oil. The proportion varying from two to four parts in 1000, in the different speci-

mens of serum, and that in no direct ratio with their turbidity, since one of the clearest furnished most oil. It was objected, however, by a friend, that my proof was not complete, unless I could ascertain that the blood in a healthy state contained oil. In order to meet this objection, I obtained oil from the serum of a dog, of a domestic fowl, and of a healthy man of twenty-five years of age. In this last case, the individual was bled four hours after taking his breakfast. His blood was perfectly healthy in appearance, and its serum was quite clear, and of a light yellow colour. The proportion of oil it contained, after treating it with æther thrice, when it no longer imparted any colour, was 3.12 parts in 1000.

It is to be observed that clear serum parts with this unctuous matter with much greater difficulty than serum which is rendered opalescent by a superabundance of it. On this account it is, that it is necessary, in order to separate the whole, to suffer the æther to remain on the serum for several days, and I am inclined to think, that the last portions are not given up, until the serum itself begins to decompose, when the oily part, being least disposed to change, is set at liberty, and unites with the æther *. This circumstance, added

* Since writing the above, I have found, that when healthy serum has been suffered to remain at rest for eight or ten days, its oil rises to the surface in the form of a cream-like cloudiness, and may then be dissolved as quickly as in the case of

to the fact, that dried fibrine, and perhaps also albumen, are convertible, according to Young, into adipocere, by digestion with æther and alcohol, led me at first to doubt whether the oil were not rather a product than an educt, being formed by some change effected by the æther itself. It is, I think, a sufficient refutation of this notion to observe, that the oil obtained by means of æther from milky serum, is identically the same in all its properties, including its colour, as that obtained from the same source by evaporation and bibulous paper ; and again, that the oil obtained from healthy serum by æther, is the same in all its characters, as that obtained from milky serum by the same means ; and finally, that when the æther has been changed once or twice, it is no longer capable of separating any more oil, though the essential properties of the serum remain unaltered.

Serum which has been clear, and from which the oil has been abstracted by æther, becomes paler than before, and turbid, so that the oil may be as essential in certain proportions to its clearness, as it is in greater proportion to its opalescence, or milkiness ; but as some of the æther remains united with the serum, it is a question how far the subsequent turbidity depends on its presence.

milky serum by means of æther. This fact furnishes an additional proof of the prior existence of the oil, and establishes beyond a doubt, that the æther has no share in its formation.

With regard to colour, the same uncertainty prevails; for though the serum becomes paler by abstracting the oil, yet it does not lose its colour altogether, which may be owing to a certain portion of oil, and therefore of the colouring principle being still retained by the æther which remains united with the serum.

From the constant presence of oil in serum, and the change that takes place in the appearance of that fluid, when it is withdrawn, I am inclined to consider it a necessary constituent of the blood. At all events, it is found in sufficient quantity, in all cases, to merit the attention of the physiologist, and cannot, excepting where serum is opalescent or milky, be justly considered as the consequence of disease.

Even in milky serum there is one circumstance which favours the supposition that the oil is a necessary constituent, namely, that it exists in superabundance, apparently at the expense of the albumen; which in all the specimens I have examined, has been remarkably deficient in proportion. This fact may be inferred from its low specific gravity, as compared with that of healthy serum. Milky serum varies in specific gravity from 1019 to 1024, while the average specific gravity of healthy serum may be stated at 1029. The salts of serum I have ascertained do not raise its specific gravity beyond that of distilled water above five parts in 1000. —The excess beyond this

increase, is owing to the presence of albumen. The quantity of other animal matter is too small to be worth considering in this respect, especially as they do not differ very materially from albumen in specific gravity. Hence, as I have said, the specific gravity of serum indicates pretty exactly the quantity of albumen which it contains.

From the detection of oil in the blood, as a general fact, and not an occasional event, I conceive that an important doubt is cleared up, which is stated in the following passage of Dr. Bostock's Physiology, and with which I shall conclude my present communication. "As a substance of an oily nature has been said to enter into the composition of the chyle, and as the formation and deposition of fat appear to bear a relation to the quantity of chyle which is produced, it has been conjectured that the oleaginous secretions originate in the process of chylication; *but it may be objected to this idea, that the fat cannot be detected in the blood.* Individual cases are indeed recorded, where the blood has exhibited an appearance as if something like cream was floating in it; but we are not well informed of the nature of this creamy matter; it is only a rare occurrence, and should probably be considered as depending upon some morbid, or at least some unusual state of the system."

I have the honour to be, Sir,

Your very obedient servant,

B. G. BABINGTON.